

Appl. No. 10/604,703
Amend. dated Jul. 9, 2007
Reply to Off. Act. of Feb. 8, 2007

Amendments to the Claims:

The following listing of claims replaces all prior versions and listings of claims in the application:

Listing of Claims:

Claims 1-87 (cancelled)

Claim 88 (currently amended): An apparatus for reliably supplying electrical energy on an as-needed basis to an electrical system connected between a system positive terminal and a system negative terminal, the electrical system including battery charging functionality, the apparatus comprising:

a main battery having a main positive output and a main negative output, the main negative output being electrically connected to the system negative terminal;

at least one standby battery having at least one standby positive output and at least one standby negative output, the at least one standby negative output being electrically connected to the system negative terminal;

a one-way charging circuit electrically connected between the main positive output and the at least one standby positive output, the one-way charging circuit configured to facilitate charging of and prevent current flow from the at least one standby battery at all times during which the main battery is supplying electrical energy to the electrical system; and

a switching device operable in at least two positions to at least selectively electrically connect the system positive terminal to one of the main positive output and the at least one standby positive output, the switching device being operable in a first position to electrically connect the main positive output to the system positive terminal and electrically disconnect the system positive terminal from the at least one standby positive output, the switching device being further operable in a second position independent of the first position to electrically connect the at least one standby positive output to the system positive terminal and electrically disconnect the system positive terminal from the main positive output,

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wherein, when the switching device is in the first position, the main battery supplies ~~is the sole source of electrical energy to the electrical system on an as-needed basis and both the main battery and the at least one standby battery receive charging current from the electrical system at times during which the electrical system is operational and the main battery is not supplying electrical energy to the electrical system.~~ [[and]] wherein, when the switching device is in the second position, the at least one standby battery supplies ~~is the sole source of electrical energy to the electrical system on an as-needed basis and only the at least one standby battery receives charging current from the electrical system at times during which the electrical system is operational and the at least one standby battery is not supplying electrical energy to the electrical system, and wherein such that the main battery and the at least one standby battery are never connected in parallel and, therefore, never supply electrical energy to the electrical system simultaneously.~~

Claim 89 (previously presented): The apparatus of claim 88, wherein the main battery is a six-volt, twelve-volt, or twenty-four volt battery.

Claim 90 (previously presented): The apparatus of claim 88, wherein the at least one standby battery is a six-volt, twelve-volt, or twenty-four volt battery.

Claim 91 (previously presented): The apparatus of claim 88, further comprising:

a battery housing that includes a main battery compartment and at least one standby battery compartment, the main battery compartment containing the main battery and the at least one standby battery compartment containing the at least one standby battery.

Claim 92 (previously presented): The apparatus of claim 91, wherein the main battery compartment is located atop the at least one standby battery compartment.

Claim 93 (previously presented): The apparatus of claim 91, wherein the battery housing comprises at least one fill tube.

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Claim 94 (previously presented): The apparatus of claim 91, wherein the battery housing has external dimensions characteristic of a conventional vehicle battery housing.

Claim 95 (previously presented): The apparatus of claim 88, wherein the one-way charging circuit comprises a diode.

Claim 96 (previously presented): The apparatus of claim 88, wherein the one-way charging circuit has an amperage rating between about 25 and 95 amps.

Claim 97 (previously presented): The apparatus of claim 88, wherein the main battery is a 12-volt automobile battery and the one-way charging circuit has an amperage rating of 45 amps.

Claim 98 (previously presented): The apparatus of claim 88, wherein the switching device is operable in a third position independent of the first position and the second position to electrically disconnect the system positive terminal from both the main positive output and the at least one standby positive output, thereby preventing electrical energy from flowing out of either the at least one standby battery or the main battery to the electrical system.

Claim 99 (previously presented): The apparatus of claim 88, further comprising:
a controller coupled to the main battery, the at least one standby battery, and the switching device, the controller operable to control operation of the switching device based on one or more operating conditions of the main battery and the at least one standby battery.

Claim 100 (previously presented): The apparatus of claim 99, wherein the one or more operating conditions of the main battery and the at least one standby battery include a voltage of the main battery, a voltage of the at least one standby battery, temperature, vibration, current flow from the main battery and current flow from the at least one standby battery.

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Claim 101 (currently amended): The apparatus of claim 88, further comprising:

a discharge cycling system coupled to the switching device and operable to periodically cause the switching device to switch from the first position to the second position so as to temporarily discharge the at least one standby battery even though the main battery is in a charged condition operating normally.

Claim 102 (previously presented): The apparatus of claim 101, wherein the discharge cycling system comprises a timer operable to periodically cause the switching device to switch from the first position to the second position, remain in the second position for a period of time, and switch back to the first position after expiration of the period of time.

Claim 103 (previously presented): The apparatus of claim 88, wherein the switching device is a three position switching device.

Claim 104 (currently amended): An apparatus for reliably supplying electrical energy on an as-needed basis to an electrical system, the electrical system including battery charging functionality, the apparatus comprising:

a main battery;

at least one standby battery;

a one-way charging circuit coupled between the main battery and the at least one standby battery, the one-way charging circuit being configured to facilitate charging of and prevent current flow from the at least one standby battery at all times during which the main battery is supplying electrical energy to the electrical system; and

a switching device coupled to the main battery, the at least one standby battery and the electrical system, the switching device being operable in a first position to permit electrical energy to flow out of the main battery to the electrical system and prevent electrical energy from flowing out of the at least one standby battery to the electrical system, the switching device being further operable in a second position independent of the first position to permit electrical energy to flow out of the at least one standby battery to the electrical and prevent electrical energy from flowing out of the main battery to the electrical,

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wherein, when the switching device is in the first position, the main battery supplies is the sole source of electrical energy to the electrical system on an as-needed basis and both the main battery and the at least one standby battery receive charging current from the electrical system at times during which the electrical system is operational and the main battery is not supplying electrical energy to the electrical system. [[and]] wherein, when the switching device is in the second position, the at least one standby battery supplies is the sole source of electrical energy to the electrical system on an as-needed basis and only the at least one standby battery receives charging current from the electrical system at times during which the electrical system is operational and the at least one standby battery is not supplying electrical energy to the electrical system, and wherein such that the main battery and the at least one standby battery are never connected in parallel and, therefore, never supply electrical energy to the electrical system simultaneously.

Claim 105 (currently amended): A method for reliably providing electrical energy on an as-needed basis from a main battery or at least one standby battery to an electrical system that includes battery charging functionality, the method comprising:

- (a) initially providing electrical energy to the electrical system solely from the main battery while preventing electrical energy from flowing out of the at least one standby battery to the electrical system;
- (b) subsequent to step (a), receiving charging current from [[using]] the electrical system to automatically charge both the main battery and the at least one standby battery during operation of the main battery; and
- (c) subsequent to step (b), [[subsequently]] providing electrical energy to the electrical system solely from the at least one standby battery while preventing electrical energy from flowing out of the main battery to the electrical system, such that the main battery and the at least one standby battery are never connected in parallel and, therefore, never supply electrical energy to the electrical system simultaneously; and
- (d) subsequent to step (c), receiving charging current from the electrical system to automatically charge the at least one standby battery only.

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Claim 106 (currently amended): A battery system for reliably supplying electrical energy on an as-needed basis to an electrical system of a motorized vehicle, the electrical system including battery charging functionality and being connected between a system positive terminal and a system negative terminal, the battery system comprising:

- a main battery having a main positive output and a main negative output, the main negative output being electrically connected to the system negative terminal;

- at least one standby battery having at least one standby positive output and at least one standby negative output, the at least one standby negative output being electrically connected to the system negative terminal;

- a one-way charging circuit electrically connected between the main positive output and the at least one standby positive output, the one-way charging circuit configured to facilitate charging of and prevent current flow from the at least one standby battery at all times during which the main battery is supplying electrical energy to the electrical system;

- a switching device positionable in any one of at least three positions to at least electrically connect the system positive terminal to one of the main positive output and the at least one standby positive output, the switching device being positionable in a first position to electrically connect the main positive output to the system positive terminal and electrically disconnect the system positive terminal from the at least one standby positive output, the switching device being further positionable in a second position independent of the first position to electrically connect the at least one standby positive output to the system positive terminal and electrically disconnect the system positive terminal from the main positive output, and the switching device being still further positionable in a third position independent of the first operating position and the second operating position to electrically disconnect the system positive terminal from both the main positive output and the at least one standby positive output, thereby preventing electrical energy from flowing out of either the at least one standby battery or the main battery to the electrical system;

- an operating condition sensor coupled to the main battery, the operating condition sensor operable to detect at least one operating condition of the main battery;

- a switch position sensor coupled to the switching device, the switch position sensor operable to detect a current position of the switching device;

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a controller coupled to at least the operating condition sensor, the switch position sensor, and the switching device, the controller operable to:

determine whether the switching device is in the first position based on an output of the switch position sensor,

determine whether the main battery is in a discharge condition based on an output of the operating condition sensor,

cause the switching device to switch to the second position responsive to determining that the switching device is in the first position and that the main battery is in the discharge condition;

periodically cause the switching device to switch to the second position for a predetermined period of time at least responsive to determining that the switching device is in the first position and that the main battery is in a charged condition operating normally, the periodic switching of the switching device to the second position partially discharging the at least one standby battery; and

upon expiration of the predetermined period of time, cause the switching device to switch back to the first position, thereby re-engaging the main battery and facilitating re-charging of the at least one standby battery by the one-way charging circuit;

wherein, when the switching device is in the first position, the main battery supplies ~~is the sole source of~~ electrical energy to the electrical system on an as-needed basis and both the main battery and the at least one standby battery receive charging current from the electrical system at times during which the electrical system is operational and the main battery is not supplying electrical energy to the electrical system. ~~[[and]]~~ wherein, when the switching device is in the second position, the at least one standby battery supplies ~~is the sole source of~~ electrical energy to the electrical system on an as-needed basis and only the at least one standby battery receives charging current from the electrical system at times during which the electrical system is operational and the at least one standby battery is not supplying electrical energy to the electrical system, and wherein such that the main battery and the at least one standby battery are never connected in parallel and, therefore, never supply electrical energy to the electrical system simultaneously.

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Claim 107 (previously presented): The battery system of claim 106, further comprising:

a second operating condition sensor coupled to the at least one standby battery, the second operating condition sensor operable to detect at least one operating condition of the at least one standby battery;

wherein the controller is further coupled to the second operating condition sensor and periodically causes the switching device to switch to the second position for the predetermined period of time responsive to determining that the switching device is in the first position, the main battery is operating normally, and the at least one standby battery is fully charged.

Claim 108 (currently amended): A method for reliably providing electrical energy on an as-needed basis from a main battery or at least one standby battery to an electrical system of a motorized vehicle that includes battery charging functionality, the method comprising:

initially providing electrical energy to the electrical system solely from the main battery while preventing electrical energy from flowing out of the at least one standby battery to the electrical system;

subsequent to said initial provision of electrical energy, receiving charging current from ~~[[using]]~~ the electrical system to automatically charge both the main battery and the at least one standby battery ~~during operation of the main battery,~~

electronically sensing whether the main battery is in a discharge condition;

when the main battery is in the discharge condition, automatically providing electrical energy, on an as-needed basis, to the electrical system solely from the at least one standby battery while preventing electrical energy from flowing out of the main battery to the electrical system, such that the main battery and the at least one standby battery ~~are never connected in parallel and, therefore,~~ never supply electrical energy to the electrical system simultaneously;

subsequent to said automatic provision of electrical energy by the at least one standby battery, receiving charging current from the electrical system to automatically charge only the at least one standby battery;

when the main battery is in a charged condition ~~operating normally,~~ periodically providing electrical energy to the electrical system, on an as-needed basis, solely from the at

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least one standby battery for a predetermined period of time to partially discharge the at least one standby battery; and

upon expiration of the predetermined period of time, re-providing electrical energy to the electrical system, on an as-needed basis, solely from the main battery.